Trans-Lake Washington Project

Highway Modal Evaluation Transportation, Environmental, and Cost Findings

Prepared for

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2. TRANSPORTATION EFFECTIVENESS

This chapter provides an initial evaluation of the transportation performance of the highway alternatives being considered by the Trans-Lake project. This is an interim step in developing multimodal alternatives for further study, leading to the second level screening to be completed in July 2001.

The analysis is designed to allow a comparison among the probable transportation benefits, impacts, and operating conditions that would occur with changes to SR 520 by the year 2020. The analysis also provides information needed to evaluate the most promising design options for the alternatives.

For transportation, twelve mobility criteria and three reliability and safety criteria were developed for the second level screening. As these criteria were designed to evaluate the overall performance of multimodal alternatives, which will include highway, transit, and transportation demand management elements, not all of the criteria were applicable to the highway modal evaluation. In addition, some of the second level screening criteria assume a level of design information and/or technical analysis that will only be available during the multimodal analysis. This report discusses all the adopted criteria and notes where the criteria was not applicable in the highway modal analysis and where additional analysis or detail will be provided in later stages of the project.

The Puget Sound Regional Council's travel demand forecasting model was the primary information source for determining future transportation demand for the highway alternatives evaluation. To establish existing conditions information, the project team also collected transportation data from the state and local jurisdictions and transportation agencies, and conducted traffic counts along the corridor.

The PSRC model directly provided forecasts of daily travel volumes for people and vehicles, and also predicted travel speeds, travel times, and the mode of travel (single occupant vehicle/commercial, high occupancy vehicle or transit). The model also provided general assumptions about future traffic growth along the corridor. A variety of other data sources and analytical tools were used to calculate future operating conditions along the corridor, including congestion, queue lengths, and local street impacts.

The discussion below addresses the transportation performance of the alternatives under each transportation criteria. Each section begins with the criteria definition, followed by key factors in the analysis, and then a discussion of the transportation performance of each alternative under the given criteria.

2.1 MOBILITY CRITERIA

The mobility criteria ranged from broad measures such as transit ridership for the entire study area, to more focused measures such as those indicating relative congestion. As noted above, these criteria were developed for the multimodal alternatives screening. Some criteria (such as transit ridership or travel demand reduction effect) are not as applicable for the highway modal analysis.

2.1.1 Travel Time

Criteria Definition: *How effective are overall point to point travel times for each alternative and travel mode? The origin-destination (O-D) pairs selected for the analysis will be the same for all alternatives. This will include calculation of weighted average travel times (weighted by the number of people using each travel mode—SOV and freight, HOV, and transit), and will include low-income/ethnic minority areas within the Trans-Lake Washington study area in the selected O-D pairs. O-D pairs will include those crossing Lake Washington and some exclusively on the east or west side of Lake Washington (e.g., Capitol Hill to University District on the west side or downtown Bellevue to downtown Kirkland on the east side).*

Travel time forecasts were obtained directly from the PSRC model. The average travel time is for all travelers at the PM peak between two points, using any combination of routes, which could include SR 522, SR 520, and I-90, as well as local streets. Although the model forecasts consider the increase in travel time caused by increased traffic congestion, the travel times may not reflect the full extent of delays caused by congestion, particularly where cross-lake facilities connect with I-5 and I-405. The forecasts still provide a reasonable point of comparison between alternatives.

Because travel time is averaged over all available corridors, some of the O-D pairs do not show a great deal of change in travel time. For instance, the Seattle to Bellevue trip shows a minimal change in travel times, even when the vehicle capacity of the SR 520 corridor is virtually doubled, as in Alternative B3. This is because a substantial portion of the trips between Seattle and Bellevue will still occur on I-90, which this analysis held constant. This tends to dilute the benefits reported for Seattle/Bellevue travelers. Other O-D pairs such as Redmond/Seattle show more marked improvements in average travel time because a greater proportion of travelers use SR 520.

Although some travel time improvements are incremental, even a small change can be considerable when the total number of vehicles and people are considered. If the number of people and/or vehicles carried is considered along with travel times, the differences among alternatives are more apparent.

The most obvious travel time difference in the forecasts is in the performance of GP versus HOV lanes, regardless of the alternatives. HOV and transit vehicles would have travel times that are 25 to 30 percent faster than non-HOV vehicles in the 2020 Baseline, and some alternatives increase this travel time difference to up to 16 minutes. Table 2-1 compares the average PM peak period travel time for existing conditions, the 2020 Baseline, and all other highway alternatives.

2.1.1.1 HOV Travel Time Savings

Both of the alternatives with HOV lanes (Alternatives B2 and B3) would provide travel time savings of up to 6 to 7 minutes for HOV travelers, compared to a 2020 Baseline (using a representative Seattle and Redmond trip). The forecasts for the other alternatives (B1 – Minimum Footprint and B5 – Bus and Vanpool Only Lanes) indicated HOV travel times that were the same or worse compared to the 2020 Baseline. Although the bus/vanpool lane in

Table 2-1. Trans-Lake Travel Time Comparison
Weighted Average PM Peak Period Travel Time (minutes) Between Designated Districts

Year 2020 Forecasts (Including all available routes and modes)

District-to-District Pair	HIGHWAY ALTERNATIVES					
	1995	2020 BASELINE	B1: MINIMUM FOOTPRINT	B2: HOV LANES Option 1/ Option 2	B3: HOV + GP LANES Option 1/ Option 2	B5: BUS & VANPOOL ONLY LANES
Downtown Seattle to Bellevue	29.5 min (GP) 25.7 min (HOV)	32.3 min (GP) 25.2 min (HOV)	(comparable to 2020 Baseline)	32.3 min (GP) 24.3 min (HOV)	31.7 min (GP) 24.0 min (HOV)	32.5 min (GP) 25.3 min (Tran.)
Downtown Seattle to Redmond	37.4 min (GP) 33.7 min (HOV)	44.7 min (GP) 35.3 min (HOV	(comparable to 2020 Baseline)	44.6 min (GP) 29.1 min (HOV)	40.9 min (GP) 27.9 min (HOV)	45.0 min (GP) 36.5 min (Tran.)
Downtown Seattle to Issaquah	38.8 min (GP) 35.8 min (HOV)	44.0 min (GP) 37.7 min (HOV	(comparable to 2020 Baseline)	44.0 min (GP) 37.6 min (HOV)	43.3 min (GP) 37.6 min (HOV)	44.1 min (GP) 37.7 min (HOV)
Downtown Seattle to Kirkland	32.0 min (GP) 29.5 min (HOV)	37.1 min (GP) 30.1 min (HOV)	(comparable to 2020 Baseline)	37.1 min (GP) 27.3 min (HOV)	36.2 min (GP) 25.8 min (HOV)	37.3 min (GP) 30.2 min (Tran.)
Redmond to North Seattle	35.2 min (GP) 33.6 min (HOV)	44.0 min (GP) 37.6 min (HOV)	(comparable to 2020 Baseline)	43.8 min (GP) 30.6 min (HOV)	41.4 min (GP) 30.8 min (HOV)	44.0 min (GP) 39.8 min (HOV)
University District to Redmond	34.2 min (GP) 33.4 min (HOV)	41.4 min (GP) 36.9 min (HOV)	(comparable to 2020 Baseline)	41.4 min (GP) 25.6 min (HOV)	37.3 min (GP) 26.3 min (HOV)	41.7 min (GP) 38.9 min (HOV)
Downtown Seattle to Bothell	40.9 min (GP) 35.2 min (HOV)	51.4 min (GP) 37.4 min (HOV)	(comparable to 2020 Baseline)	51.5 min (GP) 35.8 min (HOV)	50.8 min (GP) 34.8 min (HOV)	51.5 min (GP) 37.5 min (HOV)
Overall Weighted Average	32.8 min (GP) 29.9 min (HOV)	37.9 min (GP) 30.7 min (HOV)	(comparable to 2020 Baseline)	37.9 min (GP) 28.3 min (HOV)	36.8 min (GP) 27.7 min (HOV)	38.0 min (GP) 31.0 min (HOV)
Overall % change in Travel Times*	NA	15.4% (GP) 2.7% (HOV)	(comparable to 2020 Baseline)	0.0% (GP) -7.7% (HOV)	-2.8% (GP) -9.7% (HOV)	0.5% (GP) 1.0% (HOV)

* The 2020 Baseline change is compared to 1995 conditions. The alternatives are compared to the 2020 Baseline.

Alternative B5 would have faster vehicle speeds than the general purpose lanes, the forecasts consider all HOV travel, and not just HOV travel in the bus/vanpool lane. The slower travel speeds for carpools using general purpose lanes increases the average travel time for all HOV vehicles with Alternative B5.

Alternative B2 (HOV Lanes) would offer the highest travel time advantage for HOV travel compared to general purpose travel. For a Seattle/Redmond trip, HOV travel time would be up to 16 minutes faster than general purpose travel time, compared to a 10-minute difference under the 2020 Baseline. For Alternative B3 (HOV+GP), HOV travel would be up to 13 minutes faster than general purpose travel. Travel time advantage for the other alternatives (B1 – Minimum Footprint and B5 – Bus and Vanpool Only Lanes) was 8-10 minutes, similar to the 2020 Baseline.

2.1.1.2 General Purpose/Commercial Travel Time Savings

Alternative B3 (HOV+GP Lanes) was the only alternative to show a substantial improvement to general purpose and commercial vehicle trips. A general purpose trip from Seattle to Redmond would be 4 minutes faster than under the 2020 Baseline. (Both options for Alternative B3 had similar benefits; however, Option 2 would likely result in severe traffic congestion not reflected in the travel time information.)

Alternative B2 (HOV Lanes) would not substantially improve general purpose travel times compared to the 2020 Baseline. Alternative B5 (Bus and Vanpool Only Lanes), would also not improve general purpose travel times, and in some areas would worsen travel times (Seattle to Redmond trips).

2.1.1.3 Overall Travel Time Savings

When travel times and total vehicle and person trips are considered, Alternative B3 (HOV+GP Lanes) provides the greatest travel time savings. The alternative improved general purpose/commercial by nearly 3% and HOV travel times by up to 10% compared to the 2020 Baseline, and it would result in the highest number of people and vehicles moved through the corridor. Alternative B2 (HOV Lanes) would have the next highest level of performance because it improves travel times by over 10% in HOV lanes and results in higher person and vehicle volumes in the corridor compared to the 2020 Baseline. The other alternatives (B1 – Minimum Footprint and B5 – Bus and Vanpool Only Lanes) would be the same or worse than the 2020 Baseline because they have similar person and vehicle volumes and/or have slower travel times in some areas.

2.1.2 Total Hours of Delay

Criteria Definition: *How effective is the alternative at reducing total person hours of delay compared to the No Action alternative?*

The total hours of delay combines a quantification of congestion-related delay, taken with total person hours of delay. This detailed calculation was not possible at this stage of evaluation because it depends on the completion of several other analytical steps. A key part of the analysis requires a traffic model that simulates current and future travel conditions along the entire corridor. This simulation tool has been developed and tested to existing conditions and to the 2020 Baseline, and it will be applied to alternatives in the multimodal analysis. Although total hours of delay can be calculated by using the PSRC regional model, the results would be similar to the travel time criteria above. The model also lacks the ability to fully account for the range of delays caused by congestion at different points in the corridor.

2.1.3 Transit Ridership

Three measures for transit ridership will be used in the analysis of multimodal alternatives: regional transit ridership, study area transit ridership, and ridership by subarea. These measures were not directly applied in the highway modal evaluation because all alternatives assumed the same levels of transit service. However, the modal analysis developed forecasts for daily transit ridership forecasts across the lake, and this information is provided in Table 2-2 below. Transit ridership is also a factor in the mode split and person throughput criteria discussions.

Table 2-2. Trans-Lake Transit Ridership Forecasts

Facilities	2020 BASELINE	B1: MINIMUM FOOTPRINT	B2: HOV LANES Option 1/Option 2	B3: HOV + GP LANES Option 1/Option 2	B5: BUS & VANPOOL ONLY LANES
SR 520	23,200	23,200	51,300/51,300	55,200/56,100	38,900
All Trans-Lake Routes	48,200	48,200	74,500/74,400	79,800/80,900	68,600

Note: The transit forecast results for the highway modal alternatives cannot be directly compared to the HCT modal results. A different forecasting model and different assumptions about regional transit system operations were used in the two analyses. However, the multimodal analysis will provide comparative information.

2.1.4 Vehicle Miles Traveled and Vehicle Hours Traveled

Criteria Definition: *Vehicle Miles Traveled/Person Miles Traveled (VMT/PMT) and Vehicle Hours Traveled/Person Hours Traveled (VHT/PHT)—Daily, AM-peak-period and PM-peak-period VMT/PMT and VHT/PHT within the Trans-Lake Washington study area will be quantified.*

Estimates of future vehicle-miles traveled (VMT) and vehicle-hours traveled (VHT) were directly output from the regional traffic model. For the modal assessment, daily values only were developed, and person miles traveled was not calculated, but these additional details will be supplied in the later multimodal evaluation. Table 2-3 summarizes VMT and VHT for each of the alternatives.

Table 2-3. Study Area and Regional Vehicle Miles Traveled/Vehicle Hours Traveled

VMT and VHT	HIGHWAY ALTERNATIVES				
	2020 BASELINE	B2: HOV LANES Option 1/Option 2	B3: HOV + GP LANES Option 1	B3: HOV + GP LANES Option 2	B5: BUS & VANPOOL ONLY LANES
Study Area					
Vehicle-Miles Traveled	20,198,000	20,247,000	20,690,000	20,785,000	20,202,000
% change*	32.8%	0.2%	2.4%	2.9%	0.0%
Vehicle-Hours Traveled	1,021,000	1,023,000	1,035,000	1,042,000	1,023,000
% change*	90.8%	0.2%	1.4%	2.1%	0.2%
Regional					
Vehicle-Miles Traveled	100,596,000	100,614,000/ 100,599,000	100,991,000	101,099,000	100,596,000
% change*	44.7%	0.0%	0.4%	0.5%	0.0%
Vehicle-Hours Traveled	3,943,000	3,945,000/ 3,944,000	3,954,000	3,960,000	3,947,000
% change*	72.0%	0.1%/0.0%	0.3%	0.4%	0.1%

* The Baseline %change is compared to 1995. The alternatives %change is compared to the 2020 Baseline.

Alternative B3 (HOV+GP) is the only alternative that increases VMT and VHT by any significant amount. However, Alternative B3 would increase VMT more than it would increase VHT, which suggests that while average trip lengths areawide would increase, the alternative

would also lower travel times, reflecting congestion relief and shorter in-vehicle times per trip. Option 2 of Alternative B3, which would include new access to the Mercer/Fairview area, would result in the greatest increase in hours and miles of travel. This would appear to be due to the improved travel times from the freeway to this area, combined with the substantial growth in jobs and housing that is planned there.

Alternative B2 (HOV Lanes) would result in minor increases in VMT and VHT over the 2020 Baseline. Alternative B5 would result in virtually no increase in VMT and a minor increase in VHT.

2.1.5 Traffic Volumes

Criteria Definition: *Daily, AM-peak-period and PM-peak-period traffic volumes will be summarized and compared at 10 to 15 locations on freeway and principal arterial links within the Trans-Lake Washington study area.*

Traffic volume forecasts in the area are derived from the PSRC regional travel demand model, which provided forecasts for travel across a single north/south screenline that bisects Lake Washington. The initial forecasts from the PSRC model are provided below in Table 2-4, but they are provided for informational purposes only in this criteria discussion. These forecasts were provided in an initial findings report to the committee, but they represented preliminary results that had not been subjected to additional processing.

Table 2-4.
Regional Forecasts for Year 2020 Daily Traffic Volumes (Trans-Lake Screenline)

	HIGHWAY ALTERNATIVES				
	2020 BASELINE	B1: MINIMUM FOOTPRINT	B2: HOV LANES Option 1/Option 2	B3: HOV + GP LANES Option 1/Option 2	B5: BUS & VANPOOL ONLY LANES
Daily Traffic Volumes in 2020					
SR 520	121,200	121,200*	130,900/130,500	177,800/ 185,100	120,600
All Trans-Lake	362,800	362,800*	368,900/368,900	412,500/ 419,800	363,600

Source: Puget Sound Regional Council Forecasting Model

Alternative B1: Minimum Footprint assumes the same daily forecast values as a 2020 Baseline because no additional daily lane capacity would be provided. Some safety and reliability benefits during peak periods would be expected with Alternative B1 improvements, but they would not be likely to significantly change the daily forecast values.

The Trans-Lake screenline is a north/south line that bisects the SR-522, SR-520, and I-90 corridors.

HOVs represent autos with 3 or more occupants. Non-HOVs are vehicles with a driver and up to one passenger.

A substantial amount of additional analysis was needed to develop forecasts for different locations within the corridor and on adjacent facilities, including detailed collection and review of existing conditions information. The project team also developed and applied a traffic model to simulate conditions on the freeway and connecting facilities. Using this model, projected 2020 daily, AM peak hour and PM peak hour traffic volumes were compared at nine locations in the study area: four on SR 520, three on I-5 and two on I-405. The results of this analytical effort are shown in Table 2-5 for existing conditions (Year 2000) and the 2020 Baseline

alternatives. Tables 1-6 and 1-7 show similar traffic volume information for Alternatives B2, B3, and B5.[1]

For the purposes of comparing the alternatives, either the regional demand model or the more detailed traffic model methods provide a reasonable estimate of the proportionate increase in future traffic volumes. However, the more detailed traffic model is able to also show how traffic growth affects specific locations, and also reflects how access to and from SR 520 might be affected. These forecasts will continue to be refined with more detailed analysis during the development of multimodal alternatives, second level screening, and during the EIS.

The traffic volume forecasts represent the demand for travel, but they do not necessarily indicate how many vehicles will be served, particularly during the peak hour. SR 520 is currently operating over its theoretical capacity, and this condition is expected to continue into the future. The volumes represent the estimated growth in demand that would be expected with each of the alternatives. Further analysis is needed to quantify how many vehicles will be served. This additional analysis will reflect factors such as bottleneck locations in the corridor, maximum corridor capacity, and other operating conditions.

[1] There are some differences between the traffic volume forecasts of the PSRC regional model and the more detailed freeway operations model. However, the results are within an acceptable margin of error (+ or – 10%). The results from both models were needed to provide the full range of information required for the modal analysis.

Table 2-5. Existing and Year 2020 Forecast Traffic Volumes by Location

	Existing (2000)					2020 Baseline[1]				
	AM		PM		Daily	AM		PM		Daily
Location	EB	WB	EB	WB	Bi-Directional	EB	WB	EB	WB	Bi-Directional
SR 520										
Between I-5 and Montlake	3300	4882	3038	4145	106355	3632	5374	3344	4562	117063
Mid-Span Bridge	3955	4925	3569	4245	115575	4354	5421	3929	4672	127211
Between Bellevue Way and 92nd Ave NE	3850	4572	3642	4020	111280	4238	5033	4009	4425	122484
Between I-405 and 124th Ave NE	5194	5067	4681	4969	147035	5717	5577	5152	5469	161839
	NB	SB	NB	SB		NB	SB	NB	SB	
I-5										
South of SR 520	5282	9602	7380	8613	237040	5814	10568	8124	9480	260906
North of SR 520	4357	7095	6989	7014	213050	4796	7809	7692	7721	234501
Express Lanes (Ship Canal)	N/A	5900	5175	N/A	52060	N/A	6494	5696	N/A	57302
I-405										
South of SR 520	6440	6466	8405	6105	218555	7088	7117	9251	6720	240560
North of SR 520	5182	6390	8122	5384	186635	5704	7033	8939	5926	205426

Sources: Puget Sound Regional Model; WSDOT NW Region TSMC; additional traffic counts by Trans-Lake Washington Project team.

[1] - No-build and minimum footprint are assumed to have the same traffic volumes

Note: AM peak hour from 7:30 to 8:30, PM peak hour from 4:30 to 5:30

Table 2-6. Year 2020 Traffic Volume Forecasts by Location
Alternative B2 (HOV Lanes) and Alternative B5 (Bus and Vanpool Only Lanes)

	Alt B2					Alt B5				
	AM		PM		Daily	AM		PM		Daily
Location	EB	WB	EB	WB	Bi-Directional	EB	WB	EB	WB	Bi-Directional
SR 520										
Between I-5 and Montlake	3837	5677	3533	4819	123663	3620	5355	3332	4546	116648
Mid-Span Bridge	4599	5726	4150	4936	134383	4338	5401	3915	4656	126760
Between Bellevue Way and 92nd Ave NE	4476	5316	4235	4674	129389	4223	5015	3995	4409	122049
Between I-405 and 124th Ave NE	6040	5892	5443	5777	170963	5697	5557	5134	5450	161265
	NB	SB	NB	SB		NB	SB	NB	SB	
I-5										
South of SR 520	5814	10568	8124	9480	260906	5794	10531	8095	9447	259980
North of SR 520	4796	7809	7692	7721	234501	4779	7781	7665	7693	233668
Express Lanes (Ship Canal)	N/A	6494	5696	N/A	57302	N/A	6471	5676	N/A	57098
I-405										
South of SR 520	7088	7080	9251	6710	240216	7063	7092	9218	6696	239706
North of SR 520	5704	7033	8939	5926	205426	5683	7008	8908	5904	204697

Sources: Puget Sound Regional Model; WSDOT NW Region TSMC; additional traffic counts by Trans-Lake Washington Project team.

Note: AM peak hour from 7:30 to 8:30, PM peak hour from 4:30 to 5:30

Table 2-7. Year 2020 Traffic Volume Forecasts by Location
Alternative B3 (HOV and General Purpose Lanes) Option 1 and Option 2

	Alt B3 – Opt 1*					Alt B3 - Opt 2*				
	AM		PM		Daily	AM		PM		Daily
Location	EB	WB	EB	WB	Bi-Directional	EB	WB	EB	WB	Bi-Directional
SR 520										
Between I-5 and Montlake	4793	7091	4413	6020	154467	5052	7535	4716	6213	159412
Mid-Span Bridge	5745	7153	5184	6165	167858	6003	7566	5487	6362	173224
Between Bellevue Way and 92nd Ave NE	5592	6641	5290	5838	161620	5837	7032	5576	6026	166804
Between I-405 and 124th Ave NE	7544	7359	6799	7216	213549	7705	7628	6965	7445	220315
	NB	SB	NB	SB		NB	SB	NB	SB	
I-5										
South of SR 520	5814	10568	8124	9480	260906	5728	10377	7627	9313	256295
North of SR 520	4796	7809	7692	7721	234501	4709	7809	7196	7721	234501
Express Lanes (Ship Canal)	N/A	6494	5696	N/A	57302	N/A	6494	5329	N/A	56264
I-405										
South of SR 520	7088	6904	9251	6665	238610	7088	4786	9251	5047	180668
North of SR 520	5704	7033	8939	5926	205426	5704	7033	8939	5926	205426

Sources: Puget Sound Regional Model; WSDOT NW Region TSMC; additional traffic counts by Trans-Lake Washington Project team.

Option 1: SR 520 GP lane drop/add to/from Montlake

Option 2: SR 520 GP lane drop/add to/from Eastlake/Fairview

Note: AM peak hour from 7:30 to 8:30, PM peak hour from 4:30 to 5:30

2.1.5.1 2020 Baseline Traffic Volumes

The 2020 Baseline Alternative would not include an increase in lane capacity on SR 520. A projected 10% increase in traffic volumes would occur by year 2020, and this would substantially exceed the available highway capacity. As existing traffic volumes on the corridor already exceed the available capacity at the peak, it is obvious that future growth in traffic would also not be served during the peak. Even in terms of existing conditions, the peak periods have continued to grow longer, and this growth in the peak would continue in the 2020 Baseline. In the AM peak period, the growth would most likely be earlier (prior to 6 AM) when the highway would still have available capacity. In the PM peak, growth would likely fill the minimal available capacity during mid-day hours and extend later into the evening (after 7 PM).

2.1.5.2 Alternative B2 (HOV Lanes) Traffic Volumes

Alternative B2 would add a continuous HOV lane to the SR 520 corridor in both directions. Although some segments of SR 520 already have HOV lanes in one or both directions, this alternative would significantly change operations compared to existing and 2020 Baseline conditions because the HOV lanes would move to the inside. The alternative also assumes that the HOV lanes on the west side would connect to I-5. The forecasts show that this added HOV capacity would draw more daily vehicle trips (2,500 vehicles per day, or vpd) to the SR 520 corridor and it would appear to draw HOV trips (4,200 vpd) from the other Trans-Lake corridors. Option 1 (direct connection to and from I-5 express lanes to the south) generates approximately 500 vpd more than Option 2 (HOV designation ends at I-5 and no express lane connection).

2.1.5.3 Alternative B3 (HOV and GP Lanes) Traffic Volumes

Alternative B3 would exceed the 2020 Baseline trips across SR 520 by between 56,600 vpd (Option 1/Montlake Connection) and 63,900 vpd (Option 2/Mercer-Fairview Connection). The forecasts assume that 8% or more of these trips would occur during the peak hour. This would represent more than a full lane of traffic during the peak hour of operations for both options. With this level of traffic increase the SR 520 corridor would be able to serve more trips during the peak hour, but more vehicles are clearly attracted to the corridor. Therefore, congestion is expected to remain at nearly the same level as existing conditions, although conditions would be improved from the 2020 Baseline. The addition of the general purpose lane would serve more trips in a shorter period of time, and the total length of time that the freeway would be congested would be reduced.

Considering all corridors, daily volumes would not increase as significantly as the projected increase on SR 520. Some trips would be likely to shift from other Trans-Lake corridors to take advantage of the shorter travel time on SR 520.

2.1.5.4 Alternative B5 (Bus and Vanpool Only Lanes) Traffic Volumes

Forecasts show that traffic volumes on SR 520 would decrease with Alternative 5, compared to the 2020 Baseline Alternative. A significant number of vehicles would shift from the HOV lane to the GP lanes because the bus and vanpool lanes would not allow carpools. As the general purpose lanes would already be congested under the 2020 Baseline, it is doubtful that this

additional traffic would be accommodated. Some travelers would choose other routes or switch to buses or vanpools due to the comparative travel time advantage in the bus and vanpool lane.

2.1.5.5 Traffic Volumes on Local Streets

As part of the traffic volume forecasting, 2020 daily, AM peak hour and PM peak hour traffic volumes were also developed for roadways near SR 520 interchanges west of I-405. The traffic volume increases indicate the relative changes that would result from projected increases in freeway and ramp volumes for each alternative. With Alternative B2, freeway and ramp volumes were forecast to increase by 8% compared to the 2020 Baseline. Alternative B3 would increase freeway ramp volumes by 46.7% (Option 1) to 52.7% over the 2020 Baseline.

The new trips generated by the alternative were distributed to local roadways based on existing traffic circulation patterns near each interchange. Additional analysis would be needed to identify the local traffic growth that may occur on the arterial due to other factors such as local development. Detailed traffic volume tables are provided in Appendix A to this report.

The analysis, which will be further refined for the multimodal analysis, showed that Alternative B3 would result in the highest traffic volumes on local streets in the vicinity of the freeway interchanges. Alternative B2 would also result in higher traffic volumes compared to 2020 Baseline, but the increased volumes would be substantially less than Alternative B3. Alternative B5 would result in the lowest volumes, and in many locations the volumes would be lower than the 2020 Baseline.

2.1.6 Traffic Congestion

Criteria Definition: *Volume/capacity (v/c) ratios for the AM- and PM-peak-period will be calculated and compared at the 10 to 15 locations where year 2020 traffic volume forecasts are available.*

Traffic congestion occurs when travel demand exceeds the available capacity (or supply) on a roadway. The volume/capacity ratio is a common measurement of this condition; in it, traffic volumes are divided by the available roadway capacity. Although this method was applied in the analysis, a related measure may be more useful as an indicator of the extent of congestion.

2.1.6.1 Traffic Congestion on SR 520

A measure known as the Average Annual Daily Traffic/Capacity ratio (AADT/C) measures the annualized average daily traffic demand divided by the available roadway capacity. It is similar to v/c, except it also conveys the duration and extent of congestion. The higher the number, the worse the performance. The AADT/C ratio is particularly useful for Trans-Lake because congestion is expected with all alternatives. This measure is currently being applied by WSDOT in statewide transportation planning.

The AADT/C ratio does not yet have a uniform rating scale to indicate when a given facility is deficient, but WSDOT has recommended that 11 is the maximum acceptable rating for urban roadways. SR 520 currently has an AADT/C of 15 in several segments.

Today, SR 520 currently serves approximately 6 to 7 % of its daily trips during the peak hour. This is somewhat lower than an average facility, which would serve nearly 9% of its daily trips in a peak hour. This indicates that on SR 520, nearly 3,500 vehicles are not served during the peak hour. Some of these trips are waiting in the queue, while others are shifting their time of travel, which extends the length of the peak period. Table 2-8 summarizes AADT/C measures at four locations along SR 520 for each alternative. Tabulation sheets and corridor capacity assumptions are included in Appendix A.

Table 2-8. Measure of Congestion on SR 520 in the Year 2020 (AADT/C. A rating over 11 indicates severe congestion)

Location	HIGHWAY ALTERNATIVES				
	1995	2020 Baseline and B1: MINIMUM FOOTPRINT	B2: HOV LANES Option 1/Option 2	B3: HOV + GP LANES Option 1/Option 2	B5: BUS & VANPOOL ONLY LANES
Between I-5 and Montlake[1]	15	15	13	18/13	15
Mid-Span Bridge		15	14	12/12	16
Between Bellevue Way and 92nd Ave NE		14	13	11/12	15
Between I-405 and 124th Ave NE[1]		12	14	13/14	17
Overall Qualitatitive Rating		**3**	**3**	**2 / 3**	**1**

WORST				**BEST**
1	2	3	4	5
Least Effective, Most Impacts	Low Effectiveness, Medium Impacts	Medium Effectiveness, Low Impacts	Increased Effectiveness, No Impact	Most Effective, Improved Conditions

Clearly, none of the alternatives would eliminate all congestion on SR 520. However, the analysis showed that Alternative B2 would reduce congestion compared to the 2020 Baseline. This is due to the expanded capacity from the new HOV lanes and to operating efficiencies gained by moving HOV to the inside lanes and assuming that the corridor will be constructed to State Design Standards.

Alternative B2 would worsen congestion between the 124th Ave NE interchange and I-405, compared to the 2020 Baseline. The HOV lane would be moved to the inside lane, where it would serve only HOV traffic through this section. Today the lane is open to all traffic to allow

vehicles to move to and from SR 520 and I-405. Initial analysis shows that moving the HOV lane to the inside without adding another lane would be nearly the equivalent of removing one lane from that section of SR 520.

Alternative B3 (HOV+GP) shows the lowest degree of congestion, although it would still exceed WSDOT's recommended threshold. Although the alternative would at least double the freeway's capacity, a substantial increase in traffic volumes would also occur. Option 1 (Montlake connection) would result in a very high level of congestion between Montlake Boulevard and I-5, where the corridor would narrow from 8 lanes to 6. The high level of congestion indicates that most of the new trips generated by the alternative are destined for the I-5 corridor or downtown Seattle, and not to the University area. The results for Option 2 (a direct connection from SR 520 to Mercer/Fairview) supports that conclusion: the level of congestion is reduced approaching I-5 to below Baseline 2020 conditions.

Alternative B5 (Bus and Vanpool Only Lanes) increases congestion compared to the 2020 Baseline. Increased congestion would be anticipated because of the HOV lane conversion to Transit only and the displacement of HOV traffic into the general purpose traffic lanes.

2.1.6.2 Congestion on Local Streets

Level of service (LOS) is often used as a standard by which jurisdictions identify the need for transportation improvements and assess the impacts that growth would have on transportation system operations. Level of service for roadway links is determined by calculating a volume-to-capacity ratio (V/C). The volume-to-capacity ratio was developed by comparing roadway traffic volumes to roadway capacity. The V/C ratio ranges shown in Table 2-9 were developed to determine planning level mid-block LOS on study area roadways. LOS D is the standard used in most urban areas in the Puget Sound region and serves as a reasonable initial threshold to begin identifying deficiencies in the study area.

Table 2-9. Level of Service Criteria for Roadway Segments

LOS		Volume to Capacity (V/C) Ratio
A	less than or equal to	0.3
B	less than or equal to	0.5
C	less than or equal to	0.75
D	less than or equal to	0.90
E	less than or equal to	1.0
F	greater than	1.0

Volume-to-capacity ratios and LOS were calculated for nearly 30 mid-block arterial roadway sections in the vicinity of each SR 520 freeway interchange, based on AM and PM peak hour traffic volumes. Detailed tables on the traffic volumes and the V/C and LOS analysis are collected in Appendix A. The results should be considered preliminary, and the level of analysis will increase in an EIS. Roadway capacities were determined based on existing roadway characteristics and no local improvements were assumed. As noted in the traffic volumes

section, the volumes are based on growth related to the freeway. More analysis would be required to estimate local traffic growth due to other factors. However, the results still provide a reasonable point of comparisons among alternatives because the relative impact is indicated.

It is important to note that this preliminary evaluation of local impacts assumes no mitigating improvements to local streets to accommodate increases in freeway traffic volumes and capacity. One of the purposes of this analysis was to identify potential improvements to local streets, to allow the improvements to be included in the development and analysis of multi-modal alternatives. These local street improvement projects and other mitigation measures would continue to be developed and evaluated in the Environmental Impact Statement process.

Most of the locations evaluated currently operate at LOS D or better during the AM and PM peak hours. Exceptions include the following four roadway segments:

- Mercer Street west of Fairview Avenue N (PM Peak – eastbound)
- Valley Street west of Fairview Avenue N (AM Peak – westbound)
- Montlake Blvd. north of the SR 520 Westbound Ramps (AM and PM Peaks – southbound and northbound, respectively)
- Lake Washington Blvd (Seattle) south of the SR 520 Eastbound Ramps (AM Peak – northbound)

By the 2020 Baseline year, LOS E or worse conditions would be experienced at these 4 locations, and at Northup Way/108th Avenue NE. With Alternative B2 (HOV Lanes) and Alternative B5 (Bus and Vanpool Only Lanes) the same five locations would also experience LOS E or F.

Alternative B3 (HOV+GP) would nearly double the number of affected locations operating at LOS E or F in the year 2020. Option 1 (Montlake) would increase the number of locations with LOS E or F to 10, and Option 2 (Mercer/Fairview) would increase the number of locations to 9. More of the locations listed above would worsen to LOS F, but Alternative B3 would also worsen conditions at 92nd Avenue NE/SR 520 in the AM Peak period.

2.1.7 Person Throughput

Criteria Definition: *The number of people and amount of freight being moved in each SOV and HOV lane for the corridor will be quantified. The total person throughput on freeway links for each alternative will also be quantified.*

Estimates of daily person trip volumes were directly output from the regional traffic model for SR 520 and for the combined total of all cross lake travel routes in the study area, including SR 522, SR 520, and I-90. The results shown in Table 2-10 represent the total projected daily person trips on the SR 520 midspan for each alternative, broken down by travel mode. Table 2-11 shows similar information for I-90. At this point in the analysis, forecasts for commercial trips were available in vehicle trips, but forecasts for the quantity of freight or commercial-related person trips were unavailable. Table 2-12 summarizes the projected combined total daily person trips crossing a mid-lake screenline in the project study area.

Table 2-10. Daily Person Trip Volumes – SR 520

Mode of Travel	HIGHWAY ALTERNATIVES				
	2020 BASELINE	B1: MINIMUM FOOTPRINT	B2: HOV LANES Option 1/Option 2	B3: HOV + GP LANES Option 1/Option 2	B5: BUS & VANPOOL ONLY LANES
Non-HOV	115,500	115,500	119,000/119,100	167,200/174,500	116,200
HOV (3+)	15,200	15,200	36,300/34,700	40,100/40,100	12,300
Transit	23,200	23,200	51,300/55,200	55,200/56,100	38,900
Total Person Trips	153,900	153,900	206,600/205,100	262,500/270,700	167,400

Source: PSRC Regional Forecasting Model

Note: The person trip forecasts do not treat commercial trips as a separate category as they were in the regional vehicle trip forecasts shown in Table 2-4. This results in a potential underforecast of non-HOV person trips.

Table 2-11. Daily Person Trip Volumes – I-90

Mode of Travel	HIGHWAY ALTERNATIVES				
	2020 BASELINE	B1: MINIMUM FOOTPRINT	B2: HOV LANES Option 1/Option 2	B3: HOV + GP LANES Option 1/ Option 2	B5: BUS & VANPOOL ONLY LANES
Non-HOV	162,700	162,700	163,200/163,400	161,400/161,000	163,100
HOV (3+)	25,900	25,900	13,600/14,900	14,500/14,500	28,700
Transit	20,300	20,300	18,600/18,600	19,900/20,000	24,400
Total Person Trips	208,900	208,900	195,400/196,900	195,800/195,500	216,200

Source: PSRC Regional Forecasting Model

Table 2-12. Daily Person Trip Volumes – All Cross-Lake Routes

Mode of Travel	HIGHWAY ALTERNATIVES				
	2020 BASELINE	B1: MINIMUM FOOTPRINT	B2: HOV LANES Option 1/Option 2	B3: HOV + GP LANES Option 1/Option 2	B5: BUS & VANPOOL ONLY LANES
Non-HOV	365,100	365,100	369,000/369,100	413,500/420,900	366,500
HOV(3+)	44,300	44,300	52,200/52,200	57,200/57,200	44,200
Transit	48,200	48,200	74,500/74,400	79,800/80,900	68,600
Total Person Trips	457,600	457,600	495,700/495,700	550,500/559,000	479,300

Source: PSRC Regional Forecasting Model

Alternative B3, which would add general-purpose lanes and HOV lanes, would result in the highest person throughput increase (70 to 75%) over 2020 Baseline. Alternative B2 would increase person throughput by 30 to 35% over 2020 Baseline. Alternative B5, with a transit-only lane, would increase total person throughput by approximately 9% over 2020 Baseline; most of this increase would be in transit trips.

Interestingly, the numbers as well as the percentage of people traveling by HOV or bus would increase with Alternatives B2 and B3, compared to the 2020 Baseline. This suggests that trips from other cross-lake facilities would be likely to divert to SR 520 because of the additional

HOV capacity. Some non-HOV trips would also be attracted by the additional general purpose capacity in Alternative B3, but the overall the mode shares would still improve compared to the 2020 Baseline.

The total daily person trips for all corridors generally support the conclusions made from a review of SR 520 travel alone. Total cross-lake person trips would be expected to increase by 20 to 22% with Alternative B3, 8% with Alternative B2, and 5% with Alternative B5.

A review of both tables shows that the difference in person throughput for Alternatives B2 and B3 compared to 2020 Baseline is smaller for all cross-lake routes than it is for the SR 520 facility alone. This supports the conclusion that additional capacity on SR 520 would divert some trips from other facilities. For Alternative B5, however, the overall increase in person trips (over 2020 Baseline) for all cross-lake routes is higher than the increase in person trips expected for the SR 520 facility alone. This suggests that person throughput (primarily transit trips) on cross-lake facilities other than SR 520 would also increase with Alternative B5.

2.1.7.1 Vehicle Queue Lengths

Criteria Definition: *Average and maximum vehicle queue lengths for the AM- and PM-peak-period will be quantified for each alternative on freeway and principal arterial links within the Trans-Lake Washington study area.*

This section provides a rating based on maximum and average queue lengths and duration. Although later analysis will quantify the extent of the queuing, at this early point of analysis only a relative measure was available. The current analysis is based on an examination of existing queue lengths, combined with congestion criteria described above.

The queuing analysis is designed to reflect the impact of a corridors limited capacity. Queues occur when a roadway traffic demand exceed the available roadway capacity. For example, when traffic demand is 4000 vehicles per hour and the capacity is 3600 vehicles per hour, a queue of 400 vehicles would occur. The queue ratings were developed by comparing each of the alternatives to existing data, and the extent of queuing that would occur in each direction is summarized in Table 2-13. Appendix A to this report provides background information on methods, data sources, and calculations. This analysis will continue to be refined during the multimodal alternatives evaluation.

The 2020 Baseline Alternative and Alternative B1 (Minimum Footprint) are expected to have the same level of queuing, based on average traffic demand and the assumption that the capacity improvements with Minimum Footprint would be substantially less than alternatives adding an HOV or GP lane. Although Alternative B1 could reduce incident delay, the assessment is based on average traffic volumes, which assume the corridor is incident free. (The travel time reliability criteria does account for corridor benefits that could result from added shoulder in the Minimum Footprint Alternative over the 2020 Baseline.)

Table 2-13. SR 520 Eastbound Peak Vehicle Queue Criteria Summary

Location	HIGHWAY ALTERNATIVES				
	2020 BASELINE	B1: MINIMUM FOOTPRINT	B2: HOV LANES Option 1/Option 2	B3: HOV + GP LANES Option 1/Option 2	B5: BUS & VANPOOL ONLY LANES
Between I-5 and Montlake	**3**	**3**	**3 / 3**	**2 / 3**	**3**
Mid-Span Bridge	**2**	**2**	**5 / 5**	**4 / 4**	**3**
Between Bellevue Way/ 92nd Ave NE	**3**	**3**	**3 / 3**	**3 / 3**	**3**
Between I-405 and 124th Ave NE	**3**	**3**	**1 / 1**	**3 / 3**	**1**

Westbound Peak Vehicle Queue Criteria Summary

Location	HIGHWAY ALTERNATIVES				
	2020 BASELINE	B1: MINIMUM FOOTPRINT	B2: HOV LANES Option 1/Option 2	B3: HOV + GP LANES Option 1/Option 2	B5: BUS & VANPOOL ONLY LANES
Between I-5 and Montlake	**2**	**2**	**3 / 3**	**1 / 4**	**2**
Mid-Span Bridge	**2**	**2**	**3 / 3**	**4 / 4**	**2**
Between Bellevue Way/ 92nd Ave NE	**2**	**2**	**2 / 2**	**4 / 4**	**2**
Between I-405 124th Ave NE	**3**	**3**	**2 / 2**	**3 / 3**	**2**

WORST				**BEST**
1	2	3	4	5
Least Effective, Most Impacts	Low Effectiveness, Medium Impacts	Medium Effectiveness, Low Impacts	Increased Effectiveness, No Impact	Most Effective, Improved Conditions

For Alternative B2 (HOV Lanes), the analysis indicated a marked improvement in queuing for eastbound traffic at the Mid-Span bridge. The improvement in roadway capacity along with assumed construction to State Design Standards would increase capacity. Eastbound traffic would experience increased queuing between the I-405 and 124th Ave NE interchanges, with greater queuing than would occur in the 2020 Baseline (as described in the discussion of congestion). Further engineering evaluation will be required identify options to serve traffic

from SR 520 to southbound I-405 and/or to add a through lane westbound on SR 520 at the I-405 interchange.

Alternative B5 (Bus and Vanpool Only Lanes) would have higher queue impacts than Alternative B2, because the same initial bottleneck would occur, and it would be aggravated by the addition of carpool traffic that would not be allowed in a Bus/Vanpool only lane.

Alternative B3 (HOV+GP) would experience the lowest degree of queuing of the alternatives, although queues would still occur. Eastbound queues would be similar to 2020 Baseline except between Montlake Boulevard and I-5 for Option 1. Higher traffic volumes would occur in this section between Montlake Boulevard and I-5, compared to the 2020 Baseline, and a severe queue would occur. In this same area but westbound, traffic for Option 1 would also be severely queued because the majority of the added general purpose lane would be destined for either I-5 or downtown Seattle. At mid-span, Alternative B3 would result in a less severe queue than the 2020 Baseline because of the additional lane of capacity.

2.1.7.2 Travel Demand Reduction

Criteria Definition: *The anticipated AM-peak-period, PM-peak-period, and daily travel demand reduction will be quantified for each alternative.*

Travel demand reduction was not separately evaluated in detail for the highway modal analysis. Traffic volume, VMT/VHT and mode split criteria all would provide an initial indication of the influence that an alternative would have on travel behavior. Further analysis of the potential for Travel Demand Management strategies is being conducted as part of the multimodal alternatives analysis.

2.1.7.3 Mode Shift

Criteria Definition: *The anticipated mode shift from non-HOV (general purpose) to HOV and transit will be quantified.*

The mode shift analysis is based on the PSRC model forecasts for person and vehicle trips on SR 520 and for all trans-lake routes. Projected 2020 transportation modal shares for the Build alternatives were compared to the 2020 Baseline forecasts. The results are shown in Table 2-14. Overall, the SR 520 information is the most informative because the mode shifts in the corridor are apparent. The shifts are less obvious when all Trans-Lake routes are considered.

With an additional HOV lane in each direction, either option for Alternative B2 is projected to result in total HOV/transit travel representing about 42% of corridor travel, compared to 25% with the 2020 Baseline and about 36% with either option for Alternative B3. Alternative B5, with a lane devoted exclusively to transit, is estimated to accommodate about 31% of travel demand with HOV/transit modes. This is lower than the other build alternatives due to the exclusion of carpools from the additional travel lane but it is higher than the 2020 Baseline.

Table 2-14. Mode Shift Criteria Summary
Based on Year 2020 Daily Person Trip Forecasts

Mode Shift	HIGHWAY ALTERNATIVES				
	2020 BASELINE	B1: MINIMUM FOOTPRINT	B2: HOV LANES Option 1/Option 2	B3: HOV + GP LANES Option 1/Option 2	B5: BUS & VANPOOL ONLY LANES
SR 520					
Total Percent of Daily Person Trips by HOV/Transit Modes	25%	NA (comparable to 2020 Baseline)	42.4% / 41.9%	36.3% / 35.5%	30.6%
% Carpool/Vanpool	9.9%	NA	17.6% / 16.9%	15.3% / 14.8%	7.3%
% Transit	15.1%	NA	24.8% / 25.0%	21.0% / 20.7%	23.2%
I-90					
Total Percent of Daily Person Trips by HOV/Transit Modes	22.1%	NA (comparable to 2020 Baseline)	16.5% / 17.0%	17.6% / 17.6%	24.6%
% Carpool/Vanpool	12.4%	NA	7.0% / 7.6%	7.4% / 7.4%	13.3%
% Transit	9.7%	NA	9.5% / 9.4%	10.2% / 10.2%	11.3%
All Trans-Lake Routes					
Total Percent of Daily Person Trips by HOV/Transit Modes	20.2%	NA (comparable to 2020 Baseline)	25.6% / 25.5%	24.9% / 24.7%	23.5%
% Carpool/Vanpool	9.7%	NA	10.5%	10.4% / 10.2%	9.2%
% Transit	10.5%	NA	15.0%	14.5%	14.3%

2.2 RELIABILITY AND SAFETY CRITERIA

While the mobility effectiveness criteria address the relative performance of alternatives in the corridor under "normal" travel conditions, it is important to consider how each alternative would operate with the inevitable breakdowns in corridor operations due to traffic accidents and other incidents. This section addresses the following three qualitative criteria:

- Safety – how reliable the alternative is in minimizing traffic accidents.
- Travel Time – how reliable travel time will be during non-peak hours.
- Incident Management – how well travel speeds in SOV and HOV lanes will be maintained following an incident.

2.2.1.1 Safety

Initial screening of the SR 520 accident data indicates that the primary accident type on the corridor is a rear end accident. Rear end accidents are commonly associated with stop and go traffic and sometimes poor with sight distance. Each of the alternatives proposes to improve the sight distance by providing a standard shoulder width and a roadway design that meets WSDOT State design standards. Table 2-15 summarizes the qualitative rating of each alternative for the safety criteria.

Table 2-15. Safety Criteria Qualitative Ratings

Safety Criteria	HIGHWAY ALTERNATIVES				
	2020 BASELINE	B1: MINIMUM FOOTPRINT	B2: HOV LANES Option 1/Option 2	B3: HOV + GP LANES Option 1/ Option 2	B5: BUS & VANPOOL ONLY LANES
Potential to Minimize Accidents	**1**	**2**	**3**	**4**	**2**

WORST				**BEST**
1	2	3	4	5
Least Effective, Most Impacts	Low Effectiveness, Medium Impacts	Medium Effectiveness, Low Impacts	Increased Effectiveness, No Impact	Most Effective, Improved Conditions

Alternative B3 (HOV and GP lanes) would be likely to perform best in terms of safety improvement, with Option 2 (Fairview/Eastlake) performing better than Option 1 by continuing the added travel lanes all the way to I-5. Termination of the additional GP lane at the Montlake interchange would add an additional queuing/conflict area compared to Option 2. This would result because the full lane worth of traffic generated is not anticipated to only be destined for the University area and the local arterials would not serve traffic into Seattle. Even though congestion is anticipated for all alternatives, Alternative B3 is given the best rating for safety because the duration of congestion would be less than all of the other alternatives.

Alternative B2 (HOV lanes) receives the second best rating because it provides more capacity for HOV and transit vehicles along with standard roadway design and sight distance improvements. Congestion for the general purpose lanes would be similar to 2020 Baseline, but the alternative lane for HOV provides additional safety for the corridor.

Alternative B5 receives a lower rating than Alternatives B2 and B3 because restricted lanes will increase congestion and potentially more accidents in the Alt B5 non-SOV lanes, with more variation in travel speeds.

Alternative B1 (Minimum Footprint) would provide moderate improvement with additional shoulder area. This alternative would not improve roadway capacity for HOV or GP traffic and would not improve safety to a significant degree.

2.2.1.2 Travel Time Reliability

Travel time benefits or travel time reliability is a measure of a persons travel time expectations being met on a regular basis. Results for travel time reliability are expected to be similar to the safety improvements. The addition of shoulder lanes would provide reliability improvement because incidents could be moved to the shoulder area rather than blocking a lane; however, delay on the corridor would still occur because of the shoulder distraction. Table 2-16 summarizes the qualitative rating of each alternative for the travel time reliability criteria.

Table 2-16. Travel Time Reliability Criteria Ratings

Reliability Criteria	HIGHWAY ALTERNATIVES				
	2020 BASELINE	B1: MINIMUM FOOTPRINT	B2: HOV LANES Option 1/Option 2	B3: HOV + GP LANES Option 1/Option 2	B5: BUS & VANPOOL ONLY LANES
Potential to Improve Travel Time Reliability	**1**	**2**	**3**	**3**	**3**

WORST				**BEST**
1	2	3	4	5
Least Effective, Most Impacts	Low Effectiveness, Medium Impacts	Medium Effectiveness, Low Impacts	Increased Effectiveness, No Impact	Most Effective, Improved Conditions

A poor rating was assigned to the 2020 Baseline because it is assumed that the same congestion points would occur on the corridor and the only modification to roadway shoulder widths and design would occur on the floating bridge structure.

Minimum Footprint has a slightly better rating than 2020 Baseline because additional shoulder width is proposed for all areas that currently do not have adequate shoulder for vehicles to pull out of a lane. The proposed shoulder width for this alternative is still substandard and would not provide full clearance for the adjacent lane of traffic.

Alternatives B2, B3, and B5 are assumed to provide full design standard shoulders and lane widths for the full length of SR 520. The additional shoulder width and on- and off-ramp redesign to provide full acceleration lengths and decision distances would improve the operations and would reduce the number of incidents on the corridor in comparison to 2020 Baseline. Emergency vehicles would utilize the HOV lane to expedite clearance time of incidents.

2.2.1.3 Incident Management

All alternatives with the exception of 2020 Baseline provide additional shoulder for incidents to pull out of a lane. This improvement allows for more rapid incident response because the lanes utilized to access the incident would not be blocked. Alternative B1 would not provide as good a benefit as Alternatives B2, B3 and B5 because the shoulder widths would be less; thus, the through lanes would have less capacity. Alternative B3 is given the best rating for incident management because of the additional general purpose lane that would allow emergency vehicles to more easily bypass standing traffic. Table 2-17 summarizes the qualitative rating of each alternative for the incident management criteria.

Table 2-17. Incident Management Criteria Ratings

Incident Management Criteria	HIGHWAY ALTERNATIVES				
	2020 BASELINE	B1: MINIMUM FOOTPRINT	B2: HOV LANES Option 1/Option 2	B3: HOV + GP LANES Option 1/Option 2	B5: BUS & VANPOOL ONLY LANES
Rating	**1**	**2**	**3**	**4**	**3**

WORST				**BEST**
1	2	3	4	5
Least Effective, Most Impacts	Low Effectiveness, Medium Impacts	Medium Effectiveness, Low Impacts	Increased Effectiveness, No Impact	Most Effective, Improved Conditions

3. ENVIRONMENTAL FINDINGS

The following summarizes the environmental findings for the highway alternatives for the Trans-Lake Washington Project. This summary is based on Appendix B to this report, which includes a detailed description of the affected environment, environmental consequences, and potential avoidance, minimization, or mitigation measures for 12 environmental analysis areas. The environmental findings are based on the screening criteria adopted by the Trans-Lake Washington Executive Committee on October 25, 2000. The screening criteria are described at the beginning of the discussion for each resource section. A summary table including the ratings for all environmental criteria is included at the end of this chapter.

3.1 AIR QUALITY

Screening Criteria: *A screening-level evaluation of potential effects of changes in emissions of nitrogen oxides (NOx), carbon monoxide (CO), and volatile organic compounds (VOCs) from operation will be conducted based on professional judgment and the experience of other similar projects. Anticipated VMT, VHT, and average vehicle speed will be used to assess the potential for alternatives to demonstrate conformity with requirements of the Clean Air Act Amendments.*

3.1.1 Impacts of Each Alternative

All alternatives would involve high volumes of traffic and periods of congestion, affecting the degree of vehicle emissions. By the 2020 Baseline, regional air quality is projected to be within current federal standards, in part because vehicles will be required to operate more cleanly. At the multimodal analysis, the air quality assessment will evaluate the potential for each alternative to cause the region to exceed air quality thresholds. The current analysis does not focus on this regulatory threshold, but rather reflects the relative increase in emissions that would be expected.

All alternatives would result in some level of temporary construction impacts, consisting of fugitive dust, increases in particulate matter (PM_{10} and $PM_{2.5}$), and small amounts of construction machinery emissions (carbon monoxide and nitrogen oxides).

3.1.1.1 2020 Baseline

Increased congestion along SR 520 would result in higher vehicle emissions than existing conditions.

3.1.1.2 Alternative B1: Minimum Footprint

Impacts would be similar to the 2020 Baseline. Temporary construction impacts associated with replacing the floating bridge, bridge structures, and highway sections would occur, including fugitive dust, PM_{10} and $PM_{2.5}$, and small amounts of emissions from construction machinery.

3.1.1.3 Alternative B2: HOV Lanes (Six Lanes)

Under Alternative B2, there would be somewhat higher vehicular emissions than the 2020 Baseline due to increased traffic volumes, but there would also be an improvement in the duration of congestion.

Alternative B2 would have similar types of construction impacts as described for the Minimum Footprint, but the impacts would be greater.

3.1.1.4 Alternative B3: HOV and GP Lanes (Eight Lanes)

The substantially higher traffic volumes generated by this alternative would increase vehicle emissions substantially in the corridor and would increase regional emissions by over 2 percent, based on VMT/VNT. At this level of analysis, there is insufficient data on localized conditions to differentiate the options.

Alternative B3 would have greater temporary construction impacts than Alternative B2 or the 2020 Baseline.

3.1.1.5 Alternative B5: Bus and Vanpool Only Lanes (Six Lanes)

Lower travel volumes would result in lowered vehicle emissions, although this would partly be offset by increased congestion in the corridor due to increased congestion caused by the redesignation of the existing HOV lanes in the SR 520 corridor to bus and vanpool only lanes.

Construction impacts under Alternative B3 would be similar to those associated with Alternative B2.

3.1.2 Comparative Summary and Potential Avoidance or Mitigation

Alternative B3 (Option 2) would increase traffic volumes the most and therefore would result in the highest impacts to air quality of the build alternatives. Alternatives B1 and B5 would have the lowest traffic volumes and would have the least potential to impact air quality. Alternative B1 would result in the same impacts to air quality as the 2020 Baseline, and Alternative B2 would result in less of an impact to air quality than Alternative B1, but more than Alternative B3.

Criteria	B1	B2	B3	B5
Air Quality	**3** Low Impacts	**4** Medium Impacts	**1** Most Impacts	**3** Low Impacts

3.2 WATER RESOURCES

Screening Criteria: *A qualitative analysis of potential impacts on surface and ground water, including the State 303(d) list of water bodies that do not meet water quality standards, will be conducted. The amount of new pollution-generating surface will be estimated, with consideration of measures necessary to avoid untreated discharges. The relative availability of land to accommodate stormwater runoff treatment measures will be considered. In addition, existing flooding problems in receiving streams will be identified.*

3.2.1 Impacts of Each Alternative

All alternatives (including the 2020 Baseline) would result in various temporary construction impacts. Construction impacts could result in increased turbidity, increased potential for spills, and pH changes.

3.2.1.1 Alternative B1: Minimum Footprint

Long-term water quality impacts in and around Lake Washington would be improved as the SR 520 structure would be replaced and fitted with water quality treatment facilities. Furthermore, the amount of pollutant-generating impervious surface would be 5.1 acres less than the 2020 Baseline. This alternative would require 11.1 acre-feet of stormwater detention facilities and extension of the Fairweather Creek and Yarrow Creek culverts.

3.2.1.2 Alternative B2: HOV Lanes (Six Lanes)

Water quality impacts would be improved in and around Lake Washington, as described in ____, but greater than Alternative B1. However, Alternative B2 would impact Sammamish River and Bear Creek creating 33.1 more acres of pollutant-generating impervious surface. This would require stormwater facilities to detain 25.5 acre-feet of stormwater runoff.

The following impacts could occur at specific locations along the alignment:

- The access road between Bellevue Way and 108th Avenue NE could result in substantial reaches of Yarrow Creek being converted from open channel to pipe.

- The interchange at NE 24th Street could impact the North Branch of Kelsey Creek if fill is placed in the floodplain or if the stream channel is placed in a pipe.

- Widening the alignment between West Lake Sammamish Parkway and SR 202 could displace a significant volume of floodplain storage and encroach on the floodplain of Bear Creek, which in turn could limit future restoration efforts in the vicinity of Bear Creek.

- Tunneling under Union Bay through the use of cut-and-cover construction methods could create significant water quality impacts during construction. Trenchless tunneling could avoid water quality impacts.

3.2.1.3 Alternative B3: HOV and GP Lanes (Eight Lanes)

Alternative B3 would result in similar impacts as described for Alternative B2, but would cause greater water quality and hydrologic impacts than Alternatives B1, B2, and B5. Specifically Goff Creek, North Branch of Kelsey Creek, the Sammamish River, and Bear Creek would be impacted. Overall, Alternative B3 would create 132.7 more acres of pollutant-generating impervious surface compared to the 2020 Baseline. This alternative would require 85.2 acre-feet of stormwater detention.

In addition to the impacts described for Alternative B2, Alternative B3 would result in the following impacts at specific locations along the alignment:

- The reconstruction of the SR 520/I-405 interchange could have direct impacts to Yarrow Creek.
- Could require extension of the culvert at Goff Creek.

3.2.1.4 Alternative B5: Bus and Van Only Lanes (Six Lanes)

Alternative B5 would result in the same impacts as described for Alternative B2.

3.2.2 Comparative Summary and Potential Avoidance or Mitigation

Alternative B3 would have the greatest impacts on water quality and hydrology because it would create the most impervious surface area. In addition, Alternative B3 would displace the most floodplain storage in the Bear Creek floodplain. Alternative B3 would also require the greatest volume of stormwater detention, which would help mitigate impacts of increased impervious surface. Alternatives B2, B3, and B5 could result in significant water quality impacts during any cut-and-cover construction of the tunnel under Union Bay.

In general, impacts to open streams could be avoided by using a structure that has support piers spanning the stream corridors. If Yarrow Creek could not be spanned by a structure under Alternative B3, impacts could be mitigated by placing additional reaches of Yarrow Creek into pipes or relocating the existing channel. Long-term impacts to the Bear Creek floodplain could be avoided by relocating the alignment to the south side of SR 520. Providing compensatory floodplain storage could mitigate for fill placed in the Sammamish River floodplain. Installation of retaining walls could avoid or minimize filling of the North Branch of Kelsey Creek floodplain at the NE 24th Street interchange. Temporary construction impacts to Union Bay could not be avoided under Alternatives B2, B3, and B5. Impacts could be minimized by proper cofferdam installation and use of best management practices and erosion control measures.

Criteria	B1	B2	B3	B5
Water Resources	**3** Low Impacts	**2** Medium Impacts	**1** Most Impacts	**4** Medium Impacts

3.3 FISH-BEARING STREAMS/THREATENED AND ENDANGERED SPECIES

Screening Criteria: *A qualitative assessment of potential direct effects on Lake Washington and known, mapped streams bearing listed and proposed fish species will be conducted. Potential direct effects will be reported by numbers of streams and amount of waterbody affected. A qualitative rating will reflect the seriousness and probability of the potential direct and indirect effects and potential difficulty in complying with requirements of the Endangered Species Act.*

The analysis includes state sensitive and priority species and habitats, as well as state and federally listed threatened and endangered species per the request of Washington State Department of Fish and Wildlife (letter to K. Farley from WDFW, February 23, 2001).

3.3.1 Impacts of Each Alternative

3.3.1.1 Alternative B1: Minimum Footprint

Construction activities could increase turbidity and impact shoreline habitat, particularly at the east high-rise bridge approach.

3.3.1.2 Alternative B2: HOV Lanes (Six Lanes)

Alternative B2 would shade larger areas of shoreline and water habitat in Lake Washington than the existing facility. Stormwater detention for this alternative could result in lengthening the duration of high-flow events, which could increase downstream erosion and increase stream habitat degradation, particularly in Kelsey Creek. This alternative could also cause impacts at specific locations:

- The ramps built on fill for Bellevue Way and 108th Avenue NE interchanges could result in further loss or degradation of open-channel and riparian habitat in Yarrow Creek.

- Interchange ramps built on fill at 130th Avenue NE and NE 24th Street could result in a loss of fish habitat and habitat degradation at Goff Creek (which flows into known coho and chinook salmon spawning areas) and at Valley Creek (which is passable by anadromous fish).

- Widening the Sammamish River overpass could increase shading, which, in turn, could cause a slight delay in fish migrations through the area.

Alternative B2 would result in a number of construction-related impacts, including the impacts described under Alternative B1. In addition, depending on the construction methods employed, tunneling under Union Bay would create significant water quality impacts during construction. Construction activities and location of the alignment between West Lake Sammamish Parkway and SR 202 that result in direct or indirect impacts to Bear Creek or the riparian corridor and could cause migration delays for salmon and steelhead (including ESA-listed chinook salmon).

3.3.1.3 Alternative B3: HOV and GP Lanes (Eight Lanes)

Alternative B3 would include impacts similar to those described for Alternative B2, but would be greater to fishery resources.

Alternative B3 would have a substantial increase in impervious surface area as compared to the other build alternatives; the increase in impervious surface area would result in a substantial increase in stormwater runoff. The magnitude of the stormwater retention/detention volume could lead to increased degradation of water quality and habitat conditions downstream during high-runoff periods.

3.3.1.4 Alternative B5: Bus and Vanpool Only Lanes (Six Lanes)

Alternative B5 would have the same impacts as Alternative B2.

3.3.2 Comparative Summary and Potential Avoidance or Mitigation

Alternative B3 would result in the greatest impact on fishery resources, water quality, and hydrology because it would create the most new impervious surface area and the most shading impacts. Alternative B1 would have the least impacts.

Building supporting interchange structures on piers rather than on fill would help to avoid impacts on downstream salmonid populations or habitat in Yarrow Creek. An opportunity for enhancement of Yarrow Creek exists at the Bellevue Way and 108th Avenue interchanges; the enhancement would be the removal of existing pipes and culverts that may serve as barriers to fish passage in Yarrow Creek. Installation of retaining walls or piers at the NE 24th Street interchange could avoid potential filling or shading impacts to Valley Creek. Impacts to Bear Creek could be avoided or minimized by locating the new highway alignment on the south side of SR 520, instead of on the north (Bear Creek) side. Implementation of water quality and quantity best management practices would minimize the increased surface water runoff and potential waterborne pollutants impacts. Preventing in-water construction during the fish closure window (March 15 to July 15) would avoid impacts to migrating salmonids. Aligning the Portage Bay crossing to the north of the existing highway structure would minimize shading impacts.

Criteria	B1	B2	B3	B5
Fish-Bearing Streams	**3** Low Impacts	**2** Medium Impacts	**1** Most Impacts	**2** Medium Impacts

3.4 CRITICAL UPLAND HABITAT/THREATENED AND ENDANGERED SPECIES

Screening Criteria: *A qualitative assessment of potential direct and indirect effects on known, mapped critical upland habitat and listed threatened and endangered species will be prepared. Potential effects will be estimated using data from existing records and professional judgment. Results will be reported by area of habitat affected, along with a qualitative rating that reflects the seriousness and probability of the impacts and potential difficulty in complying with requirements of the Endangered Species Act.*

The analysis includes state sensitive and priority species and habitats, as well as state and federally listed threatened and endangered species per the request of Washington State Department of Fish and Wildlife (letter to K. Farley from WDFW, February 23, 2001).

3.4.1 Impacts of Each Alternative

3.4.1.1 Alternative B1: Minimum Footprint

Alternative B1 would cause minimal impacts to priority habitat and species associated with wetland filling and vegetation removal in the Portage Bay/Union Bay area.

3.4.1.2 Alternative B2: HOV Lanes (Six Lanes)

Alternative B2 would result in impacts to priority habitat and species. Direct impacts to priority habitat would occur in the Cozy Cove, Yarrow Bay, and Yarrow Creek drainages, which are breeding locations for bald eagle and great blue heron. Direct impact would also occur to an area of urban natural open space dominated by conifer forest just north of SR 520, south of Fairweather Bay. Impacts associated with wetlands and riparian corridors along the Sammamish River and Bear Creek could impact priority habitat for bald eagle and great blue heron.

3.4.1.3 Alternative B3: HOV and GP Lanes (Eight Lanes)

Alternative B3 would have impacts similar to those described for Alternative B2; however, the impacts to Yarrow Creek and associated wetlands and priority species would be greater under Alternative B3. Reconstruction of the SR 520/I-405 interchange under this alternative would also impact priority habitats. Finally, impacts to fish populations that are prey species for bald eagle and great blue heron could indirectly impact priority species, particularly in the Bear Creek area.

3.4.1.4 Alternative B5: Bus and Vanpool Only Lanes (Six Lanes)

Alternative B5 would have the same impacts as Alternative B2.

3.4.2 Comparative Summary and Potential Avoidance or Mitigation

Alternative B3 would have the greatest impacts due to the relative amount of habitat for priority species impacted by the widest project footprint, wetland filling, and impacts to riparian/stream areas. The greatest impacts to priority species would be in Union Bay (particularly Foster Island), the Cozy Cove and Yarrow Bay wetlands, and the Sammamish River and Bear Creek associated wetlands.

Impacts to priority habitat and species could be avoided by realigning the SR 520 corridor between Lake Washington and I-405 to the south, and avoiding or minimizing impacts to the wetlands and streams at Yarrow Bay and Cozy Cove. Impacts to Bear Creek could be avoided or minimized by locating the new highway alignment on the south side of SR 520, instead of on the north (Bear Creek) side.

Criteria	B1	B2	B3	B5
Critical Upland Habitat	**3** Low Impacts	**2** Medium Impacts	**1** Most Impacts	**2** Medium Impacts

3.5 WETLANDS AND SHORELINES

Screening Criteria: *A preliminary quantitative estimate of potential direct effects on known, mapped wetlands and shorelines will be developed. The project effects will be enumerated by area and type of wetland affected (using currently available wetlands mapping), with qualitative evaluation of likely functional impacts. A broad-level analysis of habitat connectivity issues for non-ESA-listed species within the study area will also be included.*

3.5.1 Impacts of Each Alternative

3.5.1.1 Alternative B1: Minimum Footprint

Under Alternative B1, wetland impacts and functions would be minimally impacted in the Portage Bay/Union Bay area. Shoreline area impacts within Portage Bay and Lake Washington would be similar to existing conditions.

3.5.1.2 Alternative B2: HOV Lanes (Six Lanes)

Direct impacts would occur in a number of locations along the Alternative B2 alignment. Direct impacts would include removal of wetland vegetation, excavation of wetland soil, and subsequent filling of the area to place new footings in the Portage Bay/Union Bay area. Wetlands associated with Fairweather Creek, Cozy Cove, Yarrow Bay, Yarrow Creek, Valley Creek, Sammamish River, and Bear Creek drainages could be completely or partially filled. Class I wetlands and shorelines of statewide significance located in Yarrow Bay, Cozy Cove, Sammamish River, and Bear Creek drainages would be at least partially filled. Additional impacts would include redeposition of disturbed sediments and incidental filling in the immediately surrounding wetland areas.

Construction activities associated with the tunnel under Union Bay for Alternative B2 would impact the Union Bay shoreline.

Removal of the Foster Island ramps and supporting structures would provide long-term improvements in wetland function.

3.5.1.3 Alternative B3: HOV and GP Lanes (Eight Lanes)

The impacts associated with Alternative B3 would be similar to Alternative B2, except a slightly larger area of wetland would be impacted by Alternative B3.

3.5.1.4 Alternative B5: Bus and Van Only Lanes (Six Lanes)

Alternative B5 would have the same impacts as Alternative B2.

3.5.2 Comparative Summary and Potential Avoidance or Mitigation

Alternative B3 would have the greatest impacts to wetlands and shorelines. Alternatives B2, B3, and B5 would include the removal of the Foster Island ramps and supporting structures, which would provide long-term improvements in wetland function. Alternative B1 would have the least impacts to wetlands and shorelines.

Four wetlands located in Yarrow Bay, Cozy Cove, Sammamish River, and Bear Creek drainages qualify as Class I wetlands and are considered shorelines of statewide significance. The Sammamish River and Bear Creek wetlands provide habitat for threatened and endangered species. Impacts to these wetlands from Alternatives B2, B3, and B5 could be avoided by shifting the alignment outside these wetlands.

Construction within caissons would reduce any incidental impact to wetlands for any of the alternatives.

Criteria	B1	B2	B3	B5
Wetlands and Shorelines	**3** Low Impacts	**2** Medium Impacts	**1** Most Impacts	**2** Medium Impacts

3.6 NOISE AND VIBRATION

Screening Criteria: *A qualitative screening-level analysis of potential effects of noise and vibration from operations will be conducted for selected neighborhoods and other known sensitive receptors that have the potential to be more seriously affected. Professional judgment and rules of thumb will be applied to identify the potential for substantial increases in noise and vibration based on estimated changes in traffic volumes and changes in proximity of noise and vibration sources to receptors.*

3.6.1 Impacts of Each Alternative

Existing noise levels throughout much of the SR 520 corridor currently exceed federal standards. Because existing noise levels are so high, minimal to moderate changes in traffic volumes would not result in significant changes in noise levels. The greatest impact to noise levels would result from moving the noise source closer to sensitive receptors.

3.6.1.1 2020 Baseline

In 2020, noise levels along the SR 520 corridor are projected to change substantially from existing conditions. As traffic volumes increase, the speeds of vehicles would decrease, thereby offsetting any noise increases the additional traffic may cause. Increased cut-through traffic could increase noise levels in adjacent neighborhoods; however, the slight increase in noise levels would not result in substantial noise impacts.

3.6.1.2 Alternative B1: Minimum Footprint

Conditions for Alternative B1 would be similar to the 2020 Baseline.

3.6.1.3 Alternative B2: HOV Lanes (Six Lanes)

As a result of Alternative B2, the noise levels for front-line receiver locations would increase by 2 to 3 dBA as compared to the 2020 Baseline. Increases of 2 to 3 dBA are not considered substantial; to most people, a 3 dBA change is barely perceptible. Slight increases of 0 to 2 dBA are expected for nearby areas that would be sensitive to noise. The removal of the Foster Island ramps could reduce noise levels in adjacent areas, but most likely would not result in a significant reduction in noise impacts.

3.6.1.4 Alternative B3: HOV and GP Lanes (Eight Lanes)

Alternative B3 would have similar but slightly greater impacts than those described for Alternative B2. Noise levels for front-line receiver locations would increase by 4 to 5 dBA. People would start to become aware of this increase, because a 5 dBA increase is usually noticeable. Noise levels for nearby receiver locations would increase by 1 to 3 dBA.

3.6.1.5 Alternative B5: Bus and Van Only Lanes (Six Lanes)

Alternative B5 would have impacts similar to or lesser than Alternative B2. Traffic would be slower moving, but because existing noise levels in the SR 520 corridor are so high, no substantial difference in noise levels would result from HOV lanes versus bus only lanes.

3.6.2 Comparative Summary and Potential Avoidance or Mitigation

The change in the level of traffic noise impacts and noise levels among the alternatives is determined by the additional width of the roadway and projected traffic volumes. The combination of moving the roadway closer to the receivers by widening the road and allowing for additional traffic volumes would result in higher noise impacts and noise levels. Therefore, Alternative B3 would have the greatest increase in noise levels as compared to the 2020 Baseline, and Alternative B1 would have the smallest increase.

Mitigation in the form of noise barriers and depressed and lidded roadways would reduce the level of noise impacts. Mitigation may be more difficult to implement under Alternative B3 due to the wider footprint and higher potential for noise to be diffracted over the tops of noise barriers. Through a combination of creative highway design and noise mitigation methods, it is expected that noise levels could be reduced for all build alternatives by 8 to 12 dBA for receivers that are projected to have noise impacts. This would reduce the noise levels to below existing conditions.

Criteria	B1	B2	B3	B5
Noise and Vibration	**3** Low Impacts	**2** Medium Impacts	**1** Most Impacts	**2** Medium Impacts

3.7 LAND USE

Screening Criteria: *A qualitative analysis has been done to examine the direct and indirect effects of each alternative on the pattern of growth in the study area and consistency with regional and local land use plans.*

3.7.1 Impacts of Each Alternative

The following analysis considers the potential impacts to land uses along the corridor due to the construction and operation at the facility. Direct impacts would include the effects of property acquisition, loss of access, and other physical changes to land uses. Indirect impacts reflect the potential that other impacts such as increased noise, air quality degradation, traffic, or visual changes would have on land uses.

3.7.1.1 Alternative B1: Minimum Footprint

No direct or indirect impacts are anticipated. A minimal amount of additional land would be required for right-of-way. Alternative B2: HOV Lanes (Six Lanes)

Direct impacts to land use would be minimal for Alternative B2, but the impacts would be greater than those for Alternative B1. Alternative B2 would be consistent with Seattle Comprehensive Plan policies and marginally consistent with the comprehensive plan policies of Bellevue, Medina, and Redmond.

3.7.1.2 Alternative B3: HOV and GP Lanes (Eight Lanes)

Alternative B3 would have the greatest potential to require acquisition of substantial amounts of new right-of-way. This alternative would be consistent with some Seattle Comprehensive Plan policies and inconsistent with others, and somewhat consistent with the comprehensive plan policies of Bellevue, Medina, and Redmond.

3.7.1.3 Alternative B5: Bus and Van Only Lanes (Six Lanes)

Alternative B5 would have the same impacts as Alternative B2.

3.7.2 Comparative Summary and Potential Avoidance or Mitigation

For all alternatives, except Alternative B3, direct land use impacts would be minimal. Alternative B3 would have the greatest land use impacts. Only Alternative B3 could have indirect impacts, but these would be limited by the fact that access would be increased to an area that is already urbanized. Furthermore, indirect land use impacts associated with Alternative B3 would mostly be consistent with planned future land uses. There is little variation in the overall level of plan and policy consistency. Most alternatives are consistent with some policies and inconsistent with others. Seattle calls for HOV regional transportation improvements while keeping the scale of the transportation facilities consistent with surrounding land uses. Bellevue

calls for HOV and general purpose lane improvements to regional transportation facilities. Redmond calls for regional transportation improvements to the Overlake Advanced Technology Center, but a reduction in cut-through traffic on local streets. Alternatives B2 and B5 would be most consistent with existing land use policies, mainly because these alternatives represent a "middle ground" and a compromise between various City-adopted policies.

Staying within the existing SR 520 right-of-way would best avoid land use impacts, particularly within the SR 520/I-405 interchange for Alternative B3. Leftover, unused parcels could be consolidated and sold back to the public for development, if determined not to be needed for future transportation use. No other impacts would be severe enough to require mitigation.

Criteria	B1	B2	B3	B5
Land Use	**4** No Impacts	**3** Low Impacts	**1** Most Impacts	**3** Low Impacts

3.8 PARKLANDS

Screening Criteria: *A qualitative analysis of potential impacts on known Section 4(f) resources including publicly owned parks, trails, and recreation areas; and wildlife and waterfowl refuges.*

3.8.1 Impacts of Each Alternative

3.8.1.1 Alternative B1: Minimum Footprint

Alternative B1 would cause direct impacts to McCurdy Park and Washington Park/Arboretum. No proximity impacts that would constitute a Section 4(f) "constructive use" are expected.

3.8.1.2 Alternative B2: HOV Lanes (Six Lanes)

Alternative B2 would have the same impacts as Alternative B1 as well as directly impacting 10th Avenue East and Roanoke Street Park, Bagley Viewpoint, East Montlake Park, Fairweather Nature Preserve, Points Loop Trail, and the WSDOT/SR 520 trail (both existing and proposed portions). East Montlake Park would experience proximity impacts through increased noise and visual intrusion, and could be subject to a Section 4(f) Evaluation as a "constructive use." Lake Washington Boulevard, the Olmstead-designed boulevard, would be closed just east of Montlake Boulevard, thus violating the spirit of the original 1903 Olmstead Plan, and could be a Section 4(f) impact. Construction of the tunnel under Union Bay or the Montlake Cut could result in additional direct impacts to East Montlake Park and Washington Park/Arboretum, depending on the construction methods employed.

3.8.1.3 Alternative B3: HOV and GP Lanes (Eight Lanes)

Alternative B3 would have the same impacts as Alternative B2 and would impact an additional parkland resource: the Harvard-Miller/Roanoke Annex.

3.8.1.4 Alternative B5: Bus and Van Only Lanes (Six Lanes)

Alternative B5 would have the same impacts as Alternative B2.

3.8.2 Comparative Summary and Potential Avoidance or Mitigation

Alternative B3 would have the greatest number of potential parkland impacts. Alternative B1 would have fewer potential parkland impacts than Alternatives B2 and B5.

Design modifications could avoid direct impacts to 10th Avenue East and Roanoke Street Park, Bagley Viewpoint, East Montlake Park, Harvard-Miller/Roanoke Annex, Fairweather Nature Preserve, Points Loop Trail, and the WSDOT/SR 520 trail.

Direct impacts to Washington Park and Arboretum and McCurdy Park would likely not be avoided through design modifications.

Any park impact that could not be avoided would be subject to evaluation under the guidelines of Section 4(f) of the U.S. Department of Transportation Act of 1966. As part of the Section 4(f) Evaluation, avoidance alternatives would need to be considered and selected if found to be feasible and prudent.

Criteria	B1	B2	B3	B5
Parklands	**3** Low Impacts	**2** Medium Impacts	**1** Most Impacts	**2** Medium Impacts

3.9 CULTURAL RESOURCES

Screening Criteria: *Section 106 resources to be evaluated include recorded historic districts, buildings, objects, and archaeological sites.*

3.9.1 Impacts of Each Alternative

3.9.1.1 Alternative B1: Minimum Footprint

None of the currently inventoried cultural resources would be impacted by Alternative B1.

3.9.1.2 Alternative B2: HOV Lanes (Six Lanes)

Under Alternative B2, two historic properties, as mapped by the Office of Archaeology and Historic Preservation, appear to be near enough to the alternative footprint that they could receive direct or proximity impacts. The historic properties are Seward School in Eastlake and the Naval Military Hangar/Sheli House at the northeast corner of the Montlake Cut.

3.9.1.3 Alternative B3: HOV and GP Lanes (Eight Lanes)

Alternative B3 would have the same impacts as Alternative B2, plus a potential impact to the Lake Union Steam Plant and Hydro House in Eastlake. Because Alternative B3 has the widest footprint, Alternative B3 has the greatest potential to impact any unidentified cultural resources. Therefore, Alternative B3 would have the greatest impact to cultural resources of the alternatives.

3.9.1.4 Alternative B5: Bus and Van Only Lanes (Six Lanes)

Alternative B5 would have the same impacts as Alternative B2.

3.9.2 Comparative Summary and Potential Avoidance or Mitigation

Alternative B3 would have the most impacts to inventoried cultural resources (three historic properties, while Alternatives B2 and B5 would impact two inventoried cultural resources. Additional cultural resources may be recorded or discovered through surveys and, therefore, Alternative B3, having the widest footprint, would be most likely to impact any future recorded cultural resources. Slight alignment changes to any of the alternatives could likely avoid direct and proximity impacts to cultural resources.

Criteria	B1	B2	B3	B5
Cultural Resources	**4** No Impacts	**2** Medium Impacts	**1** Most Impacts	**2** Medium Impacts

3.10 DISPLACEMENTS AND DISRUPTION

Screening Criteria: *Planning-level estimates of the number of displacements by general type of land use (residential, commercial, public).*

3.10.1 Impacts of Each Alternative

For this level of analysis, displacements were considered to occur if a parcel were likely to be affected in whole or in part by an alternative. In many cases, where a parcel may only be affected partially, there may not be a displacement. As the alternatives are further defined, the assessment of potential displacements will become more accurate.

3.10.1.1 Alternative B1: Minimum Footprint

A small number of single-family displacements would result from the northern realignment of SR 520 at the Lake Washington shoreline in Medina.

3.10.1.2 Alternative B2: HOV Lanes (Six Lanes)

Alternative B2 would result in more displacements than Alternative B1. A large proportion of total displacements would occur in single-family areas concentrated around the proposed westbound off-ramp from SR 520 to Roanoke Avenue and along the northern realignment of SR 520 at the Lake Washington shoreline in Medina. Commercial displacements would be centered around the northern realignment of SR 520 in Montlake (impacting the Museum of History and Industry) and the I-405/SR 520 interchange.

3.10.1.3 Alternative B3: HOV and GP Lanes (Eight Lanes)

Alternative B3 would result in more displacements than Alternative B2. In addition to the single-family displacements described under Alternative B2, additional displacements would be concentrated from Franklin Avenue to Eastlake Avenue as a result of portal construction near Franklin Avenue and the construction of two GP lanes extending to Eastlake Avenue. In addition to the commercial displacements described under Alternative B2, additional displacements would be likely in the vicinity of the I-405/SR 520 interchange and the SR 202/SR 520 interchange.

3.10.1.4 Alternative B5: Bus and Van Only Lanes (Six Lanes)

Alternative B5 would have the same impacts as Alternative B2.

3.10.2 Comparative Summary and Potential Avoidance or Mitigation

Due to a wider footprint, Alternative B3 would result in the greatest number of displacements. Alternative B1 would have the fewest displacements, as compared to the 2020 Baseline.

Realigning the alternatives could avoid displacement impacts. If avoidance were not possible, mitigation for project-related displacement of homes and businesses would consist of relocation assistance that would enable displacees to find and acquire or rent decent, safe, and sanitary housing or comparable business facilities.

Criteria	B1	B2	B3	B5
Displacements and Disruption	**4** Low Impacts	**2** Medium Impacts	**1** Most Impacts	**2** Medium Impacts

3.11 NEIGHBORHOODS

Screening Criteria: *A qualitative screening-level evaluation of potential neighborhood quality of life impacts will be conducted through a preliminary assessment of displacements, traffic issues, noise and vibration, and changes in access related to each project alternative. This will also address the demographic characteristics of affected areas. The evaluation will use the findings and data sources identified for the other criteria that are related to neighborhood disruption.*

3.11.1 Impacts of Each Alternative

3.11.1.1 2020 Baseline

In 2020, some increased impacts to neighborhoods could occur, compared to existing conditions. Due to increases in traffic congestion, some neighborhoods adjacent to SR 520 may experience more cut-through traffic and increases in localized air quality impacts.

3.11.1.2 Alternative B1: Minimum Footprint

Impacts for Alternative B1 would be similar to the 2020 Baseline.

3.11.1.3 Alternative B2: HOV Lanes (Six Lanes)

Under Alternative B2, elimination of Foster Island ramps would improve the Montlake neighborhood visual setting. The new interchanges at 130th Avenue NE and NE 40th Street could impact Bridle Trails and Overlake neighborhoods by increasing traffic on local streets. Localized air quality would be improved because of reduced traffic congestion.

3.11.1.4 Alternative B3: HOV and GP Lanes (Eight Lanes)

The Eastlake neighborhood would be impacted by expanding I-5 into the neighborhood. Additional traffic would be added to Fairview Avenue North, thereby impacting the lower Eastlake neighborhood with increased noise. The Montlake neighborhood would experience impacts due to increased noise levels and vehicular emissions. The Portage Bay neighborhood could be impacted due to increased noise from the expanded viaduct. Increases in noise levels could be fully mitigated and likely reduced to below existing noise levels. Option 1 would result in increased air quality impacts, whereas Option 2 would improve air quality as compared to the 2020 Baseline. Additional traffic on NE 84th Street and Bellevue Way could act as a barrier and hinder intra-neighborhood movement in Clyde Hill and Northtown. The Southeast Redmond neighborhood would be impacted due to the increased traffic added into the neighborhood via the SR 520 terminus.

3.11.1.5 Alternative B5: Bus and Van Only Lanes (Six Lanes)

Alternative B5 would have the same impacts as Alternative B2.

3.11.2 Comparative Summary and Potential Avoidance or Mitigation

The magnitude of neighborhood impacts is generally related to the carrying capacity of the alternative and the increases in noise and traffic that would likely accompany capacity increases. All neighborhood effects are dampened somewhat by the fact that, in general, all improvements would take place within the existing SR 520 corridor. Impacts to the interiors of neighborhoods would only be caused by increases in cut-through traffic. Alternative B3 would have the greatest impacts because it could result in the most additional traffic. Alternative B1 would have similar impacts to either Alternative B2 or B5, particularly east of I-405, where little additional construction is proposed. The inability of Alternative B1 to accommodate regional traffic increases would likely result in increased cut-through traffic on neighborhood streets.

Because impacts to neighborhoods are largely a compilation of impacts to other resources, avoidance, minimization, and mitigation measures identified in other sections (primarily noise, air quality, and visual quality) would also apply to neighborhoods. Mitigation measures that knit the neighborhoods together to create a greater sense of community would primarily include lidding and tunneling of highway facilities.

Criteria	B1	B2	B3	B5
Neighborhoods	**2** Medium Impacts	**3** Low Impacts	**1** Most Impacts	**3** Low Impacts

3.12 VISUAL QUALITY

Screening Criteria: *A qualitative assessment of visual impacts will include identification of sensitive receptors and impacts to significant visual resources or scenic views.*

3.12.1 Impacts of Each Alternative

3.12.1.1 Alternative B1: Minimum Footprint

Due to the limited widening of SR 520, Alternative B1 would result in low- to moderate-level impacts to visual quality. The realignment of SR 520 north of the existing roadway would impact visual quality by removing mature vegetation and affecting the houseboat community in Portage Bay. It would also shift the SR 520 bridge closer to high viewer exposure and sensitivity areas and reduce the greenbelt visual buffer between SR 520 and single family residences in Medina. In addition, the installation of a retaining wall along Hunts Point Drive would reduce the visual buffer between SR 520 and single family residences.

3.12.1.2 Alternative B2: HOV Lanes (Six Lanes)

Alternative B2 would have similar types of impacts as those described for Alternative B1, but would result in more visual quality impacts because of the wider roadway. In general, widening SR 520 would reduce urban natural open space by removing mature vegetation, wetlands, and greenbelts, thereby reducing visual buffers between SR 520 and adjacent communities. In addition to the visual quality impacts described for Alternative B1, Alternative B2 would reduce the visual buffer between I-5 and the Capitol Hill and Eastlake neighborhoods, resulting in moderate- to high-level impacts. The removal of the existing ramps at Foster Island and at the Bellevue Way/108th Avenue interchange would improve visual quality, as compared to existing conditions. Overall, Alternative B2 would result in moderate-level visual quality impacts.

3.12.1.3 Alternative B3: HOV and GP Lanes (Eight Lanes)

Alternative B3 would have similar types of impacts as those described for Alternative B2, but would result in more visual quality impacts because of the wider roadway. In addition to the visual quality impacts described for Alternative B2, Alternative B3 would impact the Eastlake Avenue/Fairview Avenue area due to the tunnel portals and on/off-ramps and would affect views within the Sammamish River/Bear Creek urban natural open space systems. Overall, Alternative B3 would result in moderate- to high-level visual quality impacts.

3.12.1.4 Alternative B5: Bus and Van Only Lanes (Six Lanes)

Alternative B5 would have the same impacts as Alternative B2.

3.12.2 Comparative Summary and Potential Avoidance or Mitigation

Criteria	B1	B2	B3	B5
Visual Quality	**3** Low Impacts	**2** Medium Impacts	**1** Most Impacts	**2** Medium Impacts

3.13 OVERALL COMPARATIVE SUMMARY

The following provides a comparative summary of the level of impacts for each alternative by environmental resources.

RATING SCALE

WORST → BEST				
1	**2**	**3**	**4**	**5**
Most Impacts	Medium Impacts	Low Impacts	No Impact	Improved Environment

Environmental Criteria Ratings Summary

Environmental Criteria	Highway Alternatives			
	B1	B2	B3	B5
Air Quality	**3**	**2**	**1**	**3**
Water Resources	**3**	**2**	**1**	**2**
Fish-Bearing Streams	**3**	**2**	**1**	**2**
Critical Upland Habitat	**3**	**2**	**1**	**2**
Wetlands and Shorelines	**3**	**2**	**1**	**2**
Noise and Vibration	**3**	**2**	**1**	**2**
Land Use	**4**	**3**	**1**	**3**
Parklands	**3**	**2**	**1**	**2**
Cultural Resources	**4**	**2**	**1**	**2**
Displacements/Disruption	**3**	**2**	**1**	**2**
Neighborhoods	**2**	**3**	**1**	**3**
Visual Quality	**3**	**2**	**1**	**2**

4. COST EVALUATION

4.1 COST

The cost opinions provided in this report reflect a wide range of assumptions based on the preliminary information developed to date. Through the scoping process of the project, significant changes to the SR 520 corridor have been suggested in every segment, including at every interchange. Current design standards have been assumed for improvements throughout the corridor. The costs for each of these changes has been included to develop an understanding of the total costs involved if all improvements were made for the full corridor. It is important to recognize that this is a corridor-level estimate developed for planning purposes. A cost-benefit analysis has not yet been conducted. As more information is developed, the costs versus benefits of suggested improvements can be tested. The results may indicate that some improvements do not warrant further development, and the costs of the overall alternative may be lowered.

At this point, the costs of environmental mitigation or enhancement have not been included, but costs for these features will be part of the multi-modal assessment. The cost ranges provided for the alternatives could increase depending on the extent of other features such as lids, noise walls and other enhancement or mitigation measures, and as highway and transit facilities are combined in the corridor.

4.1.1 Inclusions

The modal capital cost opinion represents the project scope implied in the definition of alternatives report and includes the following items:

Related civil and traffic work (roadway and intersection improvements, traffic signals and gates, drainage, stormwater management, utility relocations).

Right-of-way, including relocation program and administrative and legal costs.

Agency costs (environmental analysis, engineering, construction management, administration, etc.).

4.1.2 Exclusions

Operating costs (utilities, labor)

Improvements outside those described in the engineering documents (enhancements or betterments)

Environmental mitigation (wetlands, hazardous materials, etc.)

4.1.3 Limitations

The expected accuracy range of this estimate is 30 percent to less than or up to 50 percent greater

than the figures shown, based on information available at the planning level. This planning-level cost opinion is intended only for the purpose of e comparing the different alternatives. Because of the preliminary nature of this cost opinion, final project costs will vary from those shown and will depend on actual costs for labor, construction equipment, disposal, and materials as well as surface and subsurface conditions, regulatory constraints, approach to corridor mitigation, labor productivity, competitive market conditions, final project scope, schedule, and other factors.

4.1.4 Allowances

Various allowances have been included to account for various construction items and activities typically included for capital cost opinions. Each allowance has been estimated as a percentage of the various construction items.

Traffic Control. Traffic control accounts for local limited traffic rerouting and worker safety during roadway construction. This includes, but is not limited to, flaggers, safety trucks, temporary barriers, signs, and other measures necessary to provide for worker safety and to control traffic. Due to the high volumes of traffic that travel down the SR 520 corridor, traffic control will be significant issue. This percentage varies along the corridor and by alternative.

Construction Staging. Construction staging accounts for temporary roadways, structures, and increased complexity of construction in order to keep a minimum of four lanes open for usage. Due to the high volumes of traffic that travel down the SR 520 corridor, construction staging will be extensive. This percentage varies along the corridor and by alternative depending on the perceived degree of construction sequencing complexity.

Removal Items. This allowance accounts for the removal and disposal of existing structures and roadways that will be removed during construction. This is calculated as a percentage of the construction cost and is assumed about 5 percent.

Mobilization. This percentage accounts for mobilization and demobilization of equipment and crews during construction. This typically runs about 8 percent of construction cost.

Preliminary Engineering. Preliminary engineering represents the engineering costs during the design phase of the project. Preliminary engineering is taken to be 15 percent of all construction, wetland mitigation, traffic control, item removal, contingency, and right-of-way costs.

Construction Engineering. Construction engineering represents the cost the site engineering, inspection, and project oversight during construction. Construction engineering is taken to be 15 percent of construction cost, and includes traffic control and construction staging.

4.1.5 Contingencies and Sales Tax

Contingencies, representative of the level of planning and design to date, are included within

each capital cost opinion as a percent of construction. To accurately represent the true value of work performed within the Puget Sound area, the applicable Washington State sales tax for King County has also been included for the various elements of each alternative.

Contingency. The contingency represents an attempt to account for the unknown factors and increases in scope that usually occur at the planning level. The contingency is an attempt to mitigate potential cost overruns. At the planning level, the contingency must be considered as an integral part of the actual construction cost. The contingency is applied to all construction costs, wetland mitigation, traffic control, construction staging, right-of-way, and item removal costs. Due to the lack of information at this level of engineering and scope of the project, the contingency was taken to be 15 percent for the planning Level Cost Workbook. Additional contingency needs for the estimate are addressed in the Estimating Solutions Set.

Sales Tax. The sales tax used is 8.6 percent, which is the sales tax for King County. This is applied to all physical construction costs, wetland mitigation, traffic control, removal items, and contingency.

4.1.6 Right-of Way

Right-of-way costs were based on three areas of the SR 520 corridor to take into account the difference in the average property values within neighborhoods. Right-of-way costs were obtained from WSDOT's Northwest Region real estate services. The three areas consist of the Seattle area from I-5 to Lake Washington, the Points communities' area from Lake Washington to I-405, and the area from I-405 to Redmond (Bellevue and Redmond). These right-of-way costs then received a 75 percent markup to account for legal fees, condemnation risks, relocation costs, appraisal costs, and administration costs.

Table 4-1. General Planning Level Cost Opinions by Alternative

ALTERNATIVE B-1: MINIMUM FOOTPRINT GENERAL PLANNING LEVEL COST OPINION	
Roadway Improvements	
Retrofit and Widen Portage Bay Bridge	$60,000,000
Montlake Interchange Improvements	$50,000,000
Retrofit/Widen Approach Spans and New High Rise	$260,000,000
New Floating Bridge, No Drawspan	$430,000,000
Mainline Improvements through Eastside Communities	$60,000,000
Subtotal: SR 520 Corridor (Rounded)	**$860,000,000**
Local Street Improvements	
Total Cost	**$10,000,000**
Tunnels and Specialty Items	
Total Cost (see detail sheet for cost breakdown)	**$80,000,000**
Storm Water Mitigation	
Total Cost	**$120,000,000**

Table 4-1. General Planning Level Cost Opinions by Alternative (Continued)

Environmental Mitigation and Enhancement		
Not yet determined	Total Cost	**N/A**
Alternative Scope Contingency @ 20%		**$210,000,000**
	Total: Alternative B-1 (Rounded)	**$1,280,000,000**

Table 4-1. General Planning Level Cost Opinions by Alternative (Continued)

ALTERNATIVE B-2: HOV LANES GENERAL PLANNING LEVEL COST OPINION	
Roadway Improvements	
Westside Mainline and New Portage Bay Bridge	$200,000,000
I-5 Interchange Improvements: Layout F	$140,000,000
Montlake Interchange Improvements: Layout E	$100,000,000
New Floating Bridge Approach Spans	$490,000,000
New Floating Bridge	$640,000,000
Mainline Improvements through Eastside Communities	$100,000,000
Bellevue Way Interchange	$60,000,000
Mainline Improvements East of I-405 to Redmond	$30,000,000
New 120th Ave Connection	$30,000,000
New NE 24th Street connection	$20,000,000
New NE 31st Street HOV Connection	$40,000,000
W. Lake Sammamish Parkway Improvements: Layout B	$30,000,000
Redmond Way Interchange Improvements: Layout A	$40,000,000
Subtotal: SR 520 Corridor (Rounded)	**$1,920,000,000**
Local Street Improvements	
Roadway Improvement Cost	**$120,000,000**
Tunnels and Specialty Items	
Total Cost (see detail sheet for cost breakdown)	**$140,000,000**
Storm Water Mitigation	
Total Cost	**$380,000,000**
Environmental Mitigation and Enhancement	
Not yet determined — Total Cost	**N/A**
Alternative Contingency @ 20%	**$490,000,000**
Total: Alternative B-2 (Rounded)	**$3,050,000,000**

Table 4-1. General Planning Level Cost Opinions by Alternative (Continued)

ALTERNATIVE B-3: HOV AND GP LANES GENERAL PLANNING LEVEL COST OPINION		
Roadway Improvements		
Westside Mainline and New Portage Bay Bridge		$230,000,000
I-5 Interchange Improvements: Layout D		$130,000,000
Montlake Interchange Improvements: Layout F		$180,000,000
New Floating Bridge Approach Spans		$570,000,000
New Floating Bridge		$710,000,000
Mainline Improvements through Eastside Communities		$120,000,000
Bellevue Way Improvements: Layout B		$70,000,000
New I-405 Interchange		$770,000,000
Mainline Improvements East of I-405 to Redmond		$100,000,000
New 120th Ave Connection		$30,000,000
New NE 24th Street Connection		$20,000,000
New NE 40th Street Connection		$80,000,000
W. Lake Sammamish Parkway Improvements: Layout B		$30,000,000
Redmond Way Interchange Improvements: Layout A		$40,000,000
Subtotal: SR 520 Corridor (Rounded)		**$3,080,000,000**
Local Street Improvements		
At 20% Roadway Improvement Cost		**$620,000,000**
Tunnels and Specialty Items		
Total Cost (see detail sheet for cost breakdown)		**$780,000,000**
Storm Water Mitigation		
	Total Cost	**$680,000,000**
Environmental Mitigation and Enhancement		
Not yet determined	Total Cost	**N/A**
Alternative Scope Contingency @ 20%		**$910,000,000**
Total: Alternative B-3 (Rounded)		**$6,070,000,000**
Layout Options		
Layout A: Foster Island to Montlake		**$410,000,000**
Layout B: Under Montlake Cut		**$210,000,000**

Table 4-1. General Planning Level Cost Opinions by Alternative (Continued)

ALTERNATIVE B-5: BUS AND VANPOOL ONLY LANE GENERAL PLANNING LEVEL COST OPINION		
Roadway Improvements		
Westside Mainline and New Portage Bay Bridge		$200,000,000
I-5 Interchange Improvements: Layout F		$140,000,000
Montlake Interchange Improvements: Layout E		$100,000,000
New Floating Bridge Approach Spans		$490,000,000
New Floating Bridge		$640,000,000
Mainline Improvements through Eastside Communities		$100,000,000
Bellevue Way Improvements: Layout B		$60,000,000
Mainline Improvements East of I-405 to Redmond		$30,000,000
New 120th Ave Connection		$30,000,000
New NE 24th Street connection		$20,000,000
New NE 31st Street HOV Connection		$40,000,000
W. Lake Sammamish Parkway Improvements: Layout B		$30,000,000
Redmond Way Interchange Improvements: Layout A		$40,000,000
	Subtotal: SR 520 Corridor (Rounded)	**$1,920,000,000**
Local Street Improvements		
	At 6% Roadway Improvement Cost	**$120,000,000**
Tunnels and Specialty Items		
	Total Cost (see detail sheet for cost breakdown)	**$140,000,000**
Storm Water Mitigation		
	Total Cost	**$380,000,000**
Environmental Mitigation and Enhancement		
Not yet determined	Total Cost	**N/A**
Alternative Scope Contingency @ 20%		**$490,000,000**
	Total: Alternative B-5 (Rounded)	**$3,050,000,000**